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**IS : 9704 - 1980**  
**( Reaffirmed 1996 )**

*Indian Standard*  
**METHODS OF TESTS FOR  
LINOLEUM SHEETS AND TILES**

( Second Reprint DECEMBER 1997 )

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**BUREAU OF INDIAN STANDARDS**  
**MANAK BHAVAN 9 BAHADUR SHAH ZAFAR MARG**  
**NEW DELHI 110002**

# *Indian Standard*

## METHODS OF TESTS FOR LINOLEUM SHEETS AND TILES

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(*Continued on page 2*)

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## IS : 9704 - 1980

( Continued from page 1 )

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# *Indian Standard*

## METHODS OF TESTS FOR LINOLEUM SHEETS AND TILES

### 0. FOREWORD

**0.1** This Indian Standard was adopted by the Indian Standards Institution on 26 December 1980, after the draft finalized by the Flooring and Plastering Sectional Committee had been approved by the Civil Engineering Division Council.

**0.2** The methods of test for assessing the qualitative requirements of linoleum sheet and tiles were included in IS : 653-1980\*. For facilitating the use it has been decided to cover these methods in a separate Indian Standard. While revising the methods, the actual practice being followed in the country at present, has been kept in view.

**0.3** In reporting the results of a test made in accordance with this standard, if the final value, observed or calculated, is to be rounded off, it shall be done in accordance with IS : 2-1960†.

### 1. SCOPE

**1.1** This standard covers the methods for carrying out the following tests on linoleum sheets and tiles.

<i>Tests</i>	<i>Clause Ref</i>
a) Dimensions	2
b) Squareness of tiles	3
c) Seasoning	4
d) Residual indentation	5
e) Flexibility	6
f) Water absorption	7
g) Ageing	8
h) Colour fastness to artificial light	9

### 2. DETERMINATION OF DIMENSIONS

**2.1 Object** — To determine the length, width and thickness of linoleum sheets and tiles.

\*Specification for linoleum sheets and tiles (*second revision*).

†Rules for rounding off numerical values (*revised*).

## 2.2 Measurement of Thickness

**2.2.1 Apparatus** — A micrometer having a pressure flat foot of not less than 12.7 mm nor greater than 19 mm in diameter. The anvil shall not be smaller than the pressure foot. The pressure foot shall exert a pressure of  $1.4 \pm 0.35 \text{ kgf/cm}^2$  ( $0.14 \pm 0.035 \text{ N/mm}^2$ ) in the measuring range. The micrometer shall be capable of reading up to 0.01 mm.

**2.2.2 Procedure** — The test specimen shall be placed on the anvil of the micrometer and the pressure foot lowered gently until it touches the wearing surface. Care shall be taken that the specimen is flat against the anvil of the micrometer. The thickness shall be measured at sixteen scattered points to the nearest 0.01 mm.

**2.2.3 Report** — The average of all the observations shall be reported as the thickness.

## 2.3 Measurement of Length and Width of Tiles

**2.3.1 Apparatus** — A travelling microscope or any instrument capable of measuring to an accuracy of 0.02 mm.

**2.3.2 Procedure** — Each tile sample shall be measured for length and width at the three-quarter points in each direction (see Fig. 1).

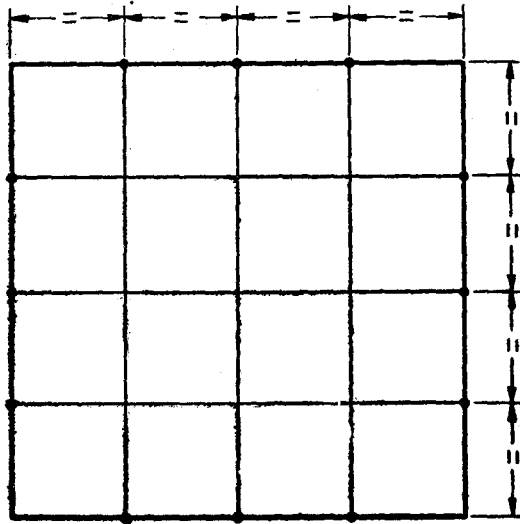


FIG. 1 MEASUREMENT OF LENGTH AND WIDTH OF TILES



**2.3.3 Report** — The average of three measurements in each direction shall be reported as the length or width of the tile in that direction.

## 2.4 Measurement of Width of Sheet or Rolls

**2.4.1 Apparatus** — A steel tape capable of measuring to the nearest 3 mm.

**2.4.2 Procedure** — The roll or sheet shall be laid in a flat surface so as to fully expose the width without distortion. The width of the specimen shall be measured in at least three places spaced equally along its length. During measurement, the tape shall be placed at right angle to the edge of the roll or sheet.

**2.4.3 Report** — The average of the readings shall be reported.

## 3. DETERMINATION OF SQUARENESS OF TILES

**3.1 Object** — To check the squareness of linoleum tiles.

### 3.2 Apparatus

**3.2.1** An L-shaped metal jig comprising two arms each of length greater than the side of the tile to be tested and of approximately same thickness, set in the shape of a true right angle on a metal base plate. This plate shall be perfectly flat and free from surface defects.

**3.2.2** A set of feeler gauges or travelling microscope capable of measuring to 0.02 mm.

**3.3 Procedure** — The tile shall be placed against the jig, each corner in turn being inserted into the right angle and one side of the tile held against one side of the jig with light pressure. Any gap between the sides of the tile and the metal arms shall be measured with the help of feeler gauge or microscope ( *see* Fig. 2 ).

**3.4 Report** — The gap measured shall be reported.

## 4. DETERMINATION OF SEASONING

**4.1 Object** — To assess the seasoning property of plain linoleum sheets and tiles.

**4.2 Apparatus** — A single-edge razor blade or equivalent cutting tool.

**4.3 Procedure** — The linoleum sample shall be clean cut at an angle of approximately 30° to the surface of the sample and kept for 24 hours ( *see* Fig. 3 ).

**4.3.1 Report** — The difference in colour on grain between the edges and the centre after 24 hours shall be examined visually and reported.

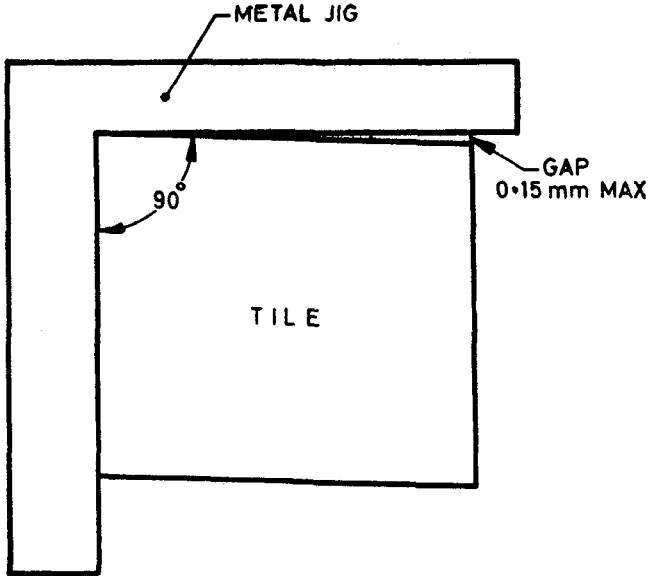


FIG. 2 METHOD OF CHECKING SQUARENESS OF TILE

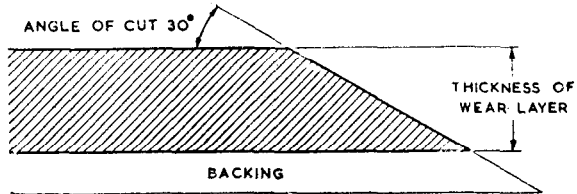


FIG. 3 METHOD OF CUTTING FOR SEASONING TEST

## 5. DETERMINATION OF RESIDUAL INDENTATION

**5.1 Object** — To determine the amount of residual indentation of linoleum sheets and tiles.

### 5.2 Apparatus

**5.2.1 Indentation Tester** — Consisting essentially of a flat ended cylindrical rod of 7 mm diameter through which a load of 30 kgf ( 300 N ) can be applied to the surface of the test piece. The edges of the face of the rod shall be buffed smooth but not rounded. The upper end of the indenter shall be provided with a weight releasing device for applying the load without impact to the indenter.

**5.2.2 Dial Micrometer** — Having a pressure flat foot and capable of reading up to 0.01 mm. The pressure foot shall exert a pressure of  $1.40 \pm 0.35$  kgf/cm<sup>2</sup> ( $0.14 \pm 0.035$  N/mm<sup>2</sup>).

**5.2.3 Steel Plate** — At least 6.35 mm thick for supporting the test piece during the test. The plate shall be rigidly fixed in a horizontal position at the bottom of the framework of the indentation testing apparatus and shall have a smooth, flat surface.

**5.2.4 Stopwatch or Other Measuring Device** — To indicate the time in seconds.

**5.3 Test Specimen** — Test pieces each measuring 50 mm<sup>2</sup> shall be cut from each sample piece.

**5.4 Conditioning** — The test pieces shall be maintained at a temperature of  $27 \pm 2^\circ\text{C}$  and at a relative humidity of  $65 \pm 5$  percent for 24 hours prior to testing.

**5.5 Procedure** — Immediately after conditioning, the thickness of the test pieces shall be measured at a marked central location to an accuracy of 0.01 mm with the dial micrometer. It shall then be placed on the steel plate of the indenter. The indenter foot shall then be lowered gently without impact, until it contacts the wearing surface of the specimen where the thickness was measured. Within 1 to 2 seconds a load of 30 kgf (300 N) shall be applied, and shall be maintained for 60 seconds. One hour after the removal of the load the depth of indentation shall be measured to the nearest 0.01 mm with the same dial micrometer.

**5.6 Report** — The residual indentation shall be the difference between the original thickness and the thickness of the indented spot. It shall be calculated as follows :

$$\text{Residual indentation, percent} = \frac{T_1 - T_2}{T_1} \times 100$$

where

$T_1$  = original thickness in mm, and

$T_2$  = indented thickness in mm.

**5.6.1** The average of five determinations shall be reported.

## 6. FLEXIBILITY

**6.1 Object** — To determine the flexibility properties of linoleum sheets and tiles.

### 6.2 Apparatus

**6.2.1 Mandrels** — 50 and 75 mm diameter.

**6.2.2 Stopwatch or Other Time Measuring Device** — To indicate the time in seconds.

**6.3 Test Specimen** — Test pieces each measuring 50 × 200 mm shall be cut from each sample piece; longitudinally and transversely.

**6.4 Conditioning** — The test pieces shall be maintained at a temperature of  $27 \pm 2^\circ\text{C}$  and a relative humidity of  $65 \pm 5$  percent for 24 hours prior to testing.

**6.5 Procedure** — Immediately after conditioning, the test piece with the wearing surface outside, shall be bent round mandrels through an arc of  $180^\circ$  in 5 seconds. A 50 mm diameter mandrel shall be used for 1.6 and 2.0 mm thick linoleum, a 75 mm diameter mandrel for 3.2 and 4.5 mm thickness.

**6.6 Report** — At the end of bending operation, the test piece shall be examined visually for breaks, cracks or other damages, and reported.

## 7. WATER ABSORPTION

**7.1 Object** — To determine the water absorption properties of linoleum sheets and tiles.

### 7.2 Apparatus

**7.2.1 Balance** — Of capacity 100 g with a sensitivity of 0.5 mg.

**7.2.2 Glass Paper**

**7.3 Test Specimens** — Test piece measuring 150 × 75 mm shall be cut from each sample piece and hessian backing removed. Both the surfaces of the test piece shall then be removed by filling down and finished by rubbing with glass paper until the surfaces are smooth and the final thickness of the sample is uniform at 75 percent of the original overall thickness.

**7.4 Conditioning** — The test piece shall then be conditioned at a temperature of  $27 \pm 2^\circ\text{C}$  and a relative humidity of  $65 \pm 5$  percent for 24 hours.

**7.5 Procedure** — Immediately after conditioning, the test piece shall be weighed and then immersed in distilled water at a temperature of  $27 \pm 2^\circ\text{C}$  for 24 hours. Immediately after removal from water, the surface of the test piece shall be wiped with dry filter paper and again weighed.

**7.6 Report** — The water absorption shall be calculated in percent by mass as follows:

$$\text{Water absorption, percent} = \frac{M_2 - M_1}{M_1} \times 100$$

where

$M_1$  = mass (g) of unimmersed test piece, and

$M_2$  = mass (g) of immersed test piece for 24 hours.

## 8. AGEING

**8.1 Object** — To determine the effect of ageing on linoleum sheet and tiles.

### 8.2 Apparatus

**8.2.1 Oven** — A circulating air oven having thermostatic control that will maintain a temperature of  $70 \pm 1^\circ\text{C}$ .

**8.3 Test Specimen** — Appropriate number of samples each measuring  $50 \times 200$  mm shall be cut from each sample piece, longitudinally and transversely.

**8.4 Procedure** — The test pieces shall be subjected to three cycles of alternate heating in the air oven at  $70 \pm 1^\circ\text{C}$  for 24 hours a fixed load of  $3.5 \text{ kg/cm}^2$  ( $0.35 \text{ N/mm}^2$ ) and then cooling to a temperature of  $27 \pm 2^\circ\text{C}$  for 24 hours with the pressure released. The test pieces shall then be subjected to various tests as specified.

**8.5 Report** — Any failure in residual indentation, flexibility, water absorption, or colour fastness or any sign of discolouration shall be reported.

## 9. COLOUR FASTNESS TO ARTIFICIAL LIGHT

**9.1 Object** — To determine the colour fastness to artificial light of linoleum sheet and tiles.

**9.2 Test Specimen** — Test piece measuring  $50 \times 25$  mm shall be cut from each sample piece.

### 9.3 Apparatus

**9.3.1 Artificial Light Source** — a xenon arc lamp with filler of correlated colour temperature 5 500 to 6 500°K.

**9.3.2 Geometric Grey Scale** — for assessing the change in colour ( see IS : 768-1956\* ).

**9.3.3 Standard Pattern** — a set of 8 standard pattern of blue wool cloth as prescribed in IS: 2454-1967†.

**9.4 Procedure** — The test pieces and the standard patterns shall be exposed to the artificial light and tested as per the procedure laid down in IS : 2454-1967†. It shall be ensured that the temperature of air

\*Method of evaluating change in colour.

†Method of determination of colour fastness of textile materials to artificial light ( xenon lamp ).

## **IS : 9704 - 1980**

surrounding the test specimens during the test shall not be more than 60°C. The test pieces and the standards shall be observed at suitable intervals until standard pattern for light fastness rating No. 5 shows fading equivalent to Grade 4 on geometric grey scale. The exposed and unexposed portions of the test specimens shall be compared with the standard pattern No. 5.

**9.5 Report** — The report shall state:

- i) Any change in the exposed and unexposed portions of the test pieces with the standard pattern No. 5 shall be reported, and
- ii) Temperature and humidity of test.

## BUREAU OF INDIAN STANDARDS

### *Headquarters:*

Manak Bhavan, 9 Bahadur Shah Zafar Marg, NEW DELHI 110002

Telephones: 323 0131, 323 3375, 323 9402

Fax: 91 11 3234062, 91 11 3239399, 91 11 3239382

Telegrams : Manaksanstha  
(Common to all Offices)

### *Central Laboratory:*

Plot No. 20/9, Site IV, Sahibabad Industrial Area, Sahibabad 201010 8-77 00 32

### *Regional Offices:*

Central : Manak Bhavan, 9 Bahadur Shah Zafar Marg, NEW DELHI 110002 323 76 17

\*Eastern : 1/14 CIT Scheme VII M, V.I.P. Road, Manikola, CALCUTTA 700054 337 86 62

Northern : SCO 335-336, Sector 34-A, CHANDIGARH 160022 60 38 43

Southern : C.I.T. Campus, IV Cross Road, CHENNAI 600113 235 23 15

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'Pushpak', Nurmohamed Shaikh Marg, Khanpur, AHMEDABAD 380001 550 13 48

‡Peenya Industrial Area, 1st Stage, Bangalore-Tumkur Road,  
BANGALORE 560058 839 49 55

Gangotri Complex, 5th Floor, Bhadbhada Road, T.T. Nagar, BHOPAL 462003 55 40 21

Plot No. 62-63, Unit VI, Ganga Nagar, BHUBANESHWAR 751001 40 36 27

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53/5 Ward No.29, R.G. Barua Road, 5th By-lane, GUWAHATI 781003 54 11 37

5-8-56C, L.N. Gupta Marg, Nampally Station Road, HYDERABAD 500001 20 10 83

E-52, Chitaranjan Marg, C-Scheme, JAIPUR 302001 37 29 25

117/418 B, Sarvodaya Nagar, KANPUR 208005 21 68 76

Seth Bhawan, 2nd Floor, Behind Leela Cinema, Naval Kishore Road,  
LUCKNOW 226001 23 89 23

NIT Building, Second Floor, Gokulpat Market, NAGPUR 440010 52 51 71

Patilputra Industrial Estate, PATNA 800013 26 23 05

Institution of Engineers (India) Building 1332 Shivaji Nagar, PUNE 411005 32 36 35

T.C. No. 14/1421, University P. O. Palayam, THIRUVANANTHAPURAM 695034 6 21 17

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\*Sales Office is at 5 Chowringhee Approach, P.O. Princep Street,  
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†Sales Office is at Novelty Chambers, Grant Road, MUMBAI 400007 309 65 28

‡Sales Office is at 'F' Block, Unity Building, Narashimaraja Square,  
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AMENDMENT NO. 1 JULY 1988

TO

IS:9704-1980 METHODS OF TESTS FOR LINOLEUM  
SHEETS AND TILES

(Page 9, clause 8.4) - Substitute the following  
for the existing clause:

'8.4 Procedure - The test pieces shall be subjected to three cycles of alternate heating in the air oven at  $70 \pm 1^{\circ}\text{C}$  for 24 hours and then cooling to a temperature of  $27 \pm 2^{\circ}\text{C}$  for 24 hours. The test pieces shall then be subjected to various tests as specified.

(BDC 5)

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**AMENDMENT NO. 2 JUNE 2003**  
**TO**  
**IS 9704 : 1990 METHOD OF TEST FOR LINOLEUM**  
**SHEETS AND TILES**

( Page 3, clause 1.1 ) — Delete:

*'Test*

*Clause Ref*

g) Ageing

8'

[ Page 3, clause 1.1(h) ] — Substitute '8' for '9'.

( Page 8, clause 6.5, lines 3 and 4 ) — Substitute "2.0" for '1.6' and '2.5' for '2.0'.

( Page 9, clause 8 ) — Delete.

( Page 9, clause 9 ) — Substitute the following for the existing clause:

**'8 COLOUR FASTNESS TO DAY LIGHT**

**8.1 Object**

To determine the colour fastness to daylight of linoleum sheet and tiles.

**8.2 Test Specimen**

Test pieces measuring 50 × 25 mm shall be cut from each sample piece.

**8.3 Apparatus**

**8.3.1 Exposure Rack** — as described in IS 686 : 1985 'Method of determination of colour fastness of textiles materials to daylighting (*first revision*).

**8.3.2 Geometric Grey Scale** — For assessing the change of colour (*see* IS 768 : 1956 'Method of evaluating change of colour'.

**8.3.3 Standard Pattern** — A set of standard pattern of Blue Wool Cloth as prescribed in IS 686 : 1985 'Method of determination of colour fastness of textiles materials to daylighting (*first revision*).

#### **8.4 Procedure**

**8.4.1** Before commencing the test procedure, expose the reference sample in full, together with blue wool standard cloth reference 2 unit a contrast is produced on blue wool standard cloth reference 2 equal to the contrast illustrated by Grey Scale 3. This step is necessary to remove the stove yellowing of linoleum before the stable colouration is achieved.

**8.4.2** The test pieces exposed as described in **8.4.1** and the standards blue wool cloth standard shall be exposed to daylight and tested as per procedure laid down in IS 686. The test pieces and the standards shall be observed at suitable intervals until standard pattern for light fastness rating No. 5 show fading equivalent to grade 4 on Geometric Grey Scale. The exposed and unexposed portions of the test specimens shall be compared with the standard pattern No. 5.

**8.5 Report** —The report shall state:

Any change in exposed and unexposed portions of the test pieces with the standard pattern No. 5 shall be reported.

( CED 5 )